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University Examinations 2014/2015

FIRST YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE DEGREE OF
BACHELOR OF TECHNOLOGY

SME 3102: MATHEMATICS II

DATE: JULY 2015

TIME: 2 HOURS

INSTRUCTIONS: Answer question *one* and any other *two* questions

QUESTION ONE (30 MARKS)

a) Given that , list the members of the set $\{4x + 1; x \in A\}$ (4 Marks)

b) Express in partial fractions $\frac{x^2 - 7}{(x - 2)(x + 1)}$ (5 Marks)

c) Find the determine of

$$\begin{vmatrix} 1 & 0 & 0 \\ 0 & \cos x & -\sin x \\ 0 & \sin x & \cos x \end{vmatrix} \quad (5 \text{ Marks})$$

d) Determine the value of $(-7 + \Omega)^4$, expressing the result in polar form (5 Marks)

e) Determine the modules and argument of the complex roots $(3 + 4i)^{\frac{1}{3}}$ (5 Marks)

f) Find the sum of the first terms of the progression $5 + 15 + 45 + \dots$ (6 Marks)

QUESTION TWO (20 MARKS)

a) Express $\frac{2}{n(n+1)(n+2)}$ in partial fractions (6 Marks)

Deduce that $\frac{1}{1.2.3} + \frac{1}{2.3.4} + \dots + \frac{1}{n(n+1)(n+2)} = \frac{1}{4} - \frac{1}{2(n+1)(n+2)}$ (7 Marks)

b) Find the values of constant A,B,C such that $5x + 3 \equiv Ax(x+3) + Bx(x-1) + C(x-1)(x+3)$ (7 Marks)

QUESTION THREE (20 MARKS)

a) Find the inverse of $\begin{pmatrix} 1 & -3 & 0 \\ 2 & 0 & 1 \\ 4 & 1 & 3 \end{pmatrix}$ Hence solve the equations $x - 3y - a = 0, 2x + z - b = 0$

and $4x + y + 3z - c = 0$ for x, y, z in terms of a, b, c (8 Marks)

b) Use the lower-upper decomposition method to solve $\begin{pmatrix} 3 & 4 & 1 \\ 2 & -1 & -1 \\ 1 & 3 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 5 \\ 4 \\ 1 \end{pmatrix}$ (7 Marks)

c) Find the eigen values of the matrix $A = \begin{bmatrix} 0.8 & 0.3 \\ 0.2 & 0.7 \end{bmatrix}$ (5 Marks)

QUESTION FOUR (20 MARKS)

a) For a transmission line, the characteristics impedance Z_0 are the propagation coefficient γ are given by

$$Z_0 = \sqrt{\frac{R + j\omega L}{G + j\omega C}}$$

$$\gamma = \sqrt{(R + j\omega L)(G + j\omega C)}$$

Given $R = 25\Omega, L = 5 \times 10^{-3} H$

$G = 80 \times 10^{-6} S, C = 0.04 \times 10^{-6} F$ and $\omega = 2000\pi$ rad/sec, determine in polar form Z_0 and γ

(5 Marks)

b) Find the sum of the series $3 + 6 + 11 + \dots + (n^2 + 2)$ (7 Marks)

c) Given the series $1 + 2x + 3x^2 + 4x^3 + \dots$ Find the sum of the first n terms when $x=1$

(5 Marks)